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L1	5	(robot OR "intelligent agent" or "autonomous agent") and "short term memory" and ("cooperative" or "swarm")	USPAT	OR	OFF	2007/07/22 18:38
L2	12	(robot OR "intelligent agent" or "autonomous agent") and "short term memory" and ("cooperative" or "swarm")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/07/22 18:38

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L1	0	"autonomous robot" and "short term memory" and "nearest neighbor" and event and "plurality of directions" and "sensory processing unit" and neighborhood . clm.	USPAT	OR	OFF	2007/07/22 21:17
L2	0	"autonomous robot" and "short term memory" and "nearest neighbor" and event and "plurality of directions" and "sensory processing unit" and neighborhood . clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/07/22 21:17

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(robot OR "intelligent agent" or "autonomous agent")

PAT. NO. Title

1 [7,171,689](#) **T** System and method for tracking and filtering alerts in an enterprise and generating alert indications for analysis

2 [7,076,472](#) **T** Knowledge-based methods for genetic network analysis and the whole cell computer system based thereon

3 [6,697,707](#) **T** Architecture for robot intelligence

4 [5,940,529](#) **T** Self-organizing circuits

5 [4,852,018](#) **T** Massively parallel real-time network architectures for robots capable of self-calibrating their operating parameters through associative learning

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IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

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1. **A communication efficiency evaluation of multi-agents with short-term memory**
Kuroda, T.; Hoshino, Y.; Itoh, H.; Seki, H.;
[Robot and Human Communication, 1994, RO-MAN '94 Nagoya, Proceedings.., 3rd IEEE International Conference on](#)
18-20 July 1994 Page(s):317 - 322
Digital Object Identifier 10.1109/ROMAN.1994.365910
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1 Cooperation through self-assembly in multi-robot systems

Elio Tuci, Roderich Gross, Vito Trianni, Francesco Mondada, Michael Bonani, Marco Dorigo
December 2006 **ACM Transactions on Autonomous and Adaptive Systems (TAAS)**,
Volume 1 Issue 2

Publisher: ACM Press

Full text available: [pdf\(2.73 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

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Full text available: [pdf\(793.48 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

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8 May 1998 **Proceedings of the second international conference on Autonomous agents AGENTS '98**

Publisher: ACM Press

Full text available:  [pdf\(849.64 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

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Publisher: ACM Press

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Keywords: Autonomic communication

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April 2006 **Proceedings of the 2006 ACM symposium on Applied computing SAC '06**

Publisher: ACM Press

Full text available:  pdf(815.11 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

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Keywords: collaborative agents, diffusion, distributed artificial intelligence, end-user programming, game AI, incremental AI, multi-agent architecture, object-oriented programming, psychology of programming

13 Excuse me, I need better AI!: employing collaborative diffusion to make game AI

 **child's play**

Alexander Repenning
July 2006 **Proceedings of the 2006 ACM SIGGRAPH symposium on Videogames sandbox '06**

Publisher: ACM Press

Full text available:  pdf(547.39 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The idea of end-user game authoring environments is quickly gaining momentum in education. Environments such as AgentSheets have been used by thousands of children to learn about programming and design by creating their own computer games. With only hours of training these children initially create their own versions of classical games such as Frogger, Sokoban, and Space Invaders and later begin to design and implement their own game ideas. After creating numerous simple games including cursor c ...

Keywords: collaborative agents, diffusion, distributed artificial intelligence, end-user programming, game AI, incremental AI, multi-agent architecture, object-oriented programming, psychology of programming

14 Industry track: Implantable medical devices as agents and part of multiagent systems 

 Touby Drew, Maria Gini

May 2006 **Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems AAMAS '06**

Publisher: ACM Press

Full text available:  [pdf\(297.91 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The consideration of medical implants as an increasingly important population of isolated agents is a valuable perspective that should not be ignored by the agent community.

Implanted Medical Device (IMD) applications are complex, naturally distributed, and could benefit from such attention. This paper explores implantable medical devices and their attributes in an agent context and terminology. It submits that an increasing body of IMDs should be considered agents and that there are opportuniti ...

Keywords: agent, implant, implantable agent, medical device, medical monitoring, multiagent system

15 Video and multimedia session: Online dispersion algorithms for swarms of robots 

 Tien-Ruey Hsiang, Esther M. Arkin, Michael A. Bender, Sandor Fekete, Joseph S. B. Mitchell
June 2003 **Proceedings of the nineteenth annual symposium on Computational geometry SCG '03**

Publisher: ACM Press

Full text available:  [pdf\(325.21 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

Keywords: NP-hardness, approximation algorithms, swarm robotics

16 Division of labor in a group of robots inspired by ants' foraging behavior 

 Thomas H. Labella, Marco Dorigo, Jean-Louis Deneubourg

September 2006 **ACM Transactions on Autonomous and Adaptive Systems (TAAS)**, Volume 1 Issue 1

Publisher: ACM Press

Full text available:  [pdf\(574.44 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In this article, we analyze the behavior of a group of robots involved in an object retrieval task. The robots' control system is inspired by a model of ants' foraging. This model emphasizes the role of learning in the individual. Individuals adapt to the environment using only locally available information. We show that a simple parameter adaptation is an effective way to improve the efficiency of the group and that it brings forth division of labor between the members of the group. Moreover, r ...

Keywords: Adaptive systems, adaptation, ant algorithms, bio-inspired systems

17 Distributed artificial intelligence: an annotated bibliography 

 B. Chaib-draa, R. Mandiau, P. Millot

August 1992 **ACM SIGART Bulletin**, Volume 3 Issue 3

Publisher: ACM Press

Full text available:  [pdf\(2.47 MB\)](#) Additional Information: [full citation](#), [index terms](#)

18 Groups and organizations: Evolving social rationality for MAS using "tags" 

 David Hales, Bruce Edmonds

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available:  pdf(210.96 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Endowing agents with "social rationality" [10, 12, 11] can aid overall efficiency in tasks where cooperation is beneficial to system level performance. However it is difficult to maintain this beneficial effect in open and unpredictable systems. Such systems seem to require a "bespoke" (that is, a new) design for cooperation in each domain. Recent work in artificial life and biological sciences has identified novel "tag" mechanisms for the spontaneous self-organization of group level adaptations ...

Keywords: altruism, cooperation, cultural markers, evolution of groups, social cues, tags

19 Teamwork: A prototype infrastructure for distributed robot-agent-person teams 

 Paul Scerri, David Pynadath, Lewis Johnson, Paul Rosenbloom, Mei Si, Nathan Schurr, Milind Tambe

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available:  pdf(360.59 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Effective coordination of robots, agents and people promises to improve the safety, robustness and quality with which shared goals are achieved by harnessing the highly heterogeneous entities' diverse capabilities. Proxy-based integration architectures are emerging as a standard method for coordinating teams of heterogeneous entities. Such architectures are designed to meet imposing challenges such as ensuring that the diverse capabilities of the group members are effectively utilized, avoiding ...

Keywords: adjustable autonomy, robot-agent-person teams

20 Active mental entities: a new approach to building intelligent autonomous agents 

 Pietro Baroni, Daniela Fogli, Giovanni Guida, Silvano Mussi

June 1998 **ACM SIGART Bulletin**, Volume 9 Issue 1

Publisher: ACM Press

Full text available:  pdf(1.69 MB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In order to design and realize intelligent autonomous agents, a very active research trend has concentrated its attention on the study of models of mental activity, encompassing the explicit representation of mental attitudes such as beliefs, desires and intentions. In such studies mental attitudes are normally represented as data structures on which a so-called interpreter operates determining the overall agent behavior. In this article we propose an original point of view about mental activity ...

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Terms used: robot OR intelligent agent or autonomous agent and short term memory and cooperative or swarm

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child's play

Alexander Repenning

July 2006 **Proceedings of the 2006 ACM SIGGRAPH symposium on Videogames sandbox '06**

Publisher: ACM Press

Full text available: [pdf\(547.39 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The idea of end-user game authoring environments is quickly gaining momentum in education. Environments such as AgentSheets have been used by thousands of children to learn about programming and design by creating their own computer games. With only hours of training these children initially create their own versions of classical games such as Frogger, Sokoban, and Space Invaders and later begin to design and implement their own game ideas. After creating numerous simple games including cursor c ...

Keywords: collaborative agents, diffusion, distributed artificial intelligence, end-user programming, game AI, incremental AI, multi-agent architecture, object-oriented programming, psychology of programming

14 Industry track: Implantable medical devices as agents and part of multiagent systems 

 Touby Drew, Maria Gini

May 2006 **Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems AAMAS '06**

Publisher: ACM Press

Full text available:  pdf(297.91 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The consideration of medical implants as an increasingly important population of isolated agents is a valuable perspective that should not be ignored by the agent community.

Implanted Medical Device (IMD) applications are complex, naturally distributed, and could benefit from such attention. This paper explores implantable medical devices and their attributes in an agent context and terminology. It submits that an increasing body of IMDs should be considered agents and that there are opportuniti ...

Keywords: agent, implant, implantable agent, medical device, medical monitoring, multiagent system

15 Video and multimedia session: Online dispersion algorithms for swarms of robots 

 Tien-Ruey Hsiang, Esther M. Arkin, Michael A. Bender, Sandor Fekete, Joseph S. B. Mitchell

June 2003 **Proceedings of the nineteenth annual symposium on Computational geometry SCG '03**

Publisher: ACM Press

Full text available:  pdf(325.21 KB) Additional Information: [full citation](#), [references](#), [index terms](#)

Keywords: NP-hardness, approximation algorithms, swarm robotics

16 Division of labor in a group of robots inspired by ants' foraging behavior 

 Thomas H. Labella, Marco Dorigo, Jean-Louis Deneubourg

September 2006 **ACM Transactions on Autonomous and Adaptive Systems (TAAS)**, Volume 1 Issue 1

Publisher: ACM Press

Full text available:  pdf(574.44 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In this article, we analyze the behavior of a group of robots involved in an object retrieval task. The robots' control system is inspired by a model of ants' foraging. This model emphasizes the role of learning in the individual. Individuals adapt to the environment using only locally available information. We show that a simple parameter adaptation is an effective way to improve the efficiency of the group and that it brings forth division of labor between the members of the group. Moreover, r ...

Keywords: Adaptive systems, adaptation, ant algorithms, bio-inspired systems

17 Distributed artificial intelligence: an annotated bibliography 

 B. Chaib-draa, R. Mandiau, P. Millot

August 1992 **ACM SIGART Bulletin**, Volume 3 Issue 3

Publisher: ACM Press

Full text available:  pdf(2.47 MB) Additional Information: [full citation](#), [index terms](#)

18 Groups and organizations: Evolving social rationality for MAS using "tags" 

 David Hales, Bruce Edmonds

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available:  pdf(210.96 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Endowing agents with "social rationality" [10, 12, 11] can aid overall efficiency in tasks where cooperation is beneficial to system level performance. However it is difficult to maintain this beneficial effect in open and unpredictable systems. Such systems seem to require a "bespoke" (that is, a new) design for cooperation in each domain. Recent work in artificial life and biological sciences has identified novel "tag" mechanisms for the spontaneous self-organization of group level adaptations ...

Keywords: altruism, cooperation, cultural markers, evolution of groups, social cues, tags

19 Teamwork: A prototype infrastructure for distributed robot-agent-person teams 

 Paul Scerri, David Pynadath, Lewis Johnson, Paul Rosenbloom, Mei Si, Nathan Schurr, Milind Tambe

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available:  pdf(360.59 KB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Effective coordination of robots, agents and people promises to improve the safety, robustness and quality with which shared goals are achieved by harnessing the highly heterogeneous entities' diverse capabilities. Proxy-based integration architectures are emerging as a standard method for coordinating teams of heterogeneous entities. Such architectures are designed to meet imposing challenges such as ensuring that the diverse capabilities of the group members are effectively utilized, avoiding ...

Keywords: adjustable autonomy, robot-agent-person teams

20 Active mental entities: a new approach to building intelligent autonomous agents 

 Pietro Baroni, Daniela Fogli, Giovanni Guida, Silvano Mussi

June 1998 **ACM SIGART Bulletin**, Volume 9 Issue 1

Publisher: ACM Press

Full text available:  pdf(1.69 MB)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In order to design and realize intelligent autonomous agents, a very active research trend has concentrated its attention on the study of models of mental activity, encompassing the explicit representation of mental attitudes such as beliefs, desires and intentions. In such studies mental attitudes are normally represented as data structures on which a so-called interpreter operates determining the overall agent behavior. In this article we propose an original point of view about mental activity ...

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Terms used: **robot** OR **intelligent agent** or **autonomous agent** and **short term memory** and **cooperative** or **swarm**

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21 Papers: robotics: Tunably decentralized algorithms for cooperative target observation

 Sean Luke, Keith Sullivan, Liviu Panait, Gabriel Balan

July 2005 Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems AAMAS '05
Publisher: ACM Press

 Full text available:  [pdf\(323.52 KB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Multi-agent problem domains may require distributed algorithms for a variety of reasons: local sensors, limitations of communication, and availability of distributed computational resources. In the absence of these constraints, centralized algorithms are often more efficient, simply because they are able to take advantage of more information. We introduce a variant of the cooperative target observation domain which is free of such constraints. We propose two algorithms, inspired by K-means clust ...

Keywords: K-means clustering, hill-climbing, multiagent systems

22 Session 2: Toward a theory of communication and cooperation for multiagent planning

Eric Werner

March 1988 Proceedings of the 2nd conference on Theoretical aspects of reasoning about knowledge TARK '88
Publisher: Morgan Kaufmann Publishers Inc.

 Full text available:  [pdf\(1.01 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#)

In this paper we develop a formal computational theory of high-level linguistic communication that serves as a foundation for understanding cooperative action in groups of autonomous agents. We do so by examining and describing how messages affect the planning process and thereby relating communication to the intentions of the agents. We start by developing an abstract formal theory of knowledge representation based on the concept of information. We distinguish two types of information: state ...

Keywords: automated reasoning, communication, distributed artificial intelligence, information, intention, knowledge representation, planning

23 Managing robot autonomy and interactivity using motives and visual communication

 François Michaud, Minh Tuan Vu

April 1999 Proceedings of the third annual conference on Autonomous Agents AGENTS '99

Publisher: ACM Press

Full text available:  pdf(963.46 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

24 Session 11A: coordination and cooperation II: Efficiency and robustness of threshold-based distributed allocation algorithms in multi-agent systems 

William Agassounon, Alcherio Martinoli

July 2002 **Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 3 AAMAS '02**

Publisher: ACM Press

Full text available:  pdf(967.81 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper we present three scalable, fully distributed, threshold-based algorithms for allocating autonomous embodied workers to a given task whose demand evolves dynamically over time. Individuals estimate the availability of work based solely on local perceptions. The differences among the algorithms lie in the threshold distribution among teammates (homogeneous or heterogeneous team), in the mechanism used for establishing threshold values (fixed, parameter-based or variable, rule-based), ...

Keywords: division of labor, embodied multi-agent systems, probabilistic modeling, response threshold, swarm intelligence

25 Posters: Directed stigmergy-based control for multi-robot systems 

Fitzgerald Steele, Geb Thomas

March 2007 **Proceeding of the ACM/IEEE international conference on Human-robot interaction HRI '07**

Publisher: ACM Press

Full text available:  pdf(320.21 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Multi-robot systems are particularly useful in tasks that require searching large areas such as planetary science exploration, urban search and rescue, or landmine remediation. In order to overcome the inherent complexity of controlling multiple robots, the user must be able to give high-level, goal driven direction to the robot team. Since human robot interaction is a relatively new discipline, it is helpful to look to existing systems for concepts, analogies, or metaphors that might be utilized ...

Keywords: human robot interaction, multi-robot, robotics, stigmergy, supervisory control, swarm, user interface

26 Modeling methodology A: parallel and distributed methods I: Parallel simulation of UAV swarm scenarios 

Joshua J. Corner, Gary B. Lamont

December 2004 **Proceedings of the 36th conference on Winter simulation WSC '04**

Publisher: Winter Simulation Conference

Full text available:  pdf(435.32 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

The concept of operations for a micro-UAV system is adopted from nature from the appearance of flocking birds, movement of a school of fish, and swarming bees among others. This "emergent behavior" is the aggregate result of many simple interactions occurring within the flock, school, or swarm. Exploration of this emergent behavior in a swarm is accomplished through a high performance computing parallel discrete event simulation. After design of the system, several experiments are designed, test ...

27 Full Papers: Hosting activities: experience with and future directions for a robot agent 

 host

Candace L. Sidner, Myroslava Dzikovska

January 2002

Proceedings of the 7th international conference on Intelligent user interfaces IUI '02

Publisher: ACM Press

Full text available:  pdf(440.84 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper discusses hosting activities.. Hosting activities are a general class of collaborative activity in which an agent provides guidance in the form of information, entertainment, education or other services in the user's environment (which may be an artificial or the natural world) and may also request that the human user undertake actions to support the fulfillment of those services. This paper reports on experience in building a robot agent for hosting activities, both the architecture a ...

Keywords: artificial intelligence, collaboration, collaborative interface agents, discourse, embodied agents, hosting agents, intelligent user interfaces, robotics

28 Bringing up robots or—the psychology of socially intelligent robots: from theory to implementation 

 Kerstin Dautenhahn, Aude Billard
April 1999 **Proceedings of the third annual conference on Autonomous Agents AGENTS '99**

Publisher: ACM Press

Full text available:  pdf(262.80 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

29 Disturbed behavior in co-operating autonomous robot 

 Robert Ghanea-Hercock, David P. Barnes
April 1999 **Proceedings of the third annual conference on Autonomous Agents AGENTS '99**

Publisher: ACM Press

Full text available:  pdf(1.20 MB) Additional Information: [full citation](#), [references](#), [index terms](#)

Keywords: adaptive, autonomous robots, fuzzy logic

30 Using RoboCup in university-level computer science education 

 Elizabeth Sklar, Simon Parsons, Peter Stone
June 2004 **Journal on Educational Resources in Computing (JERIC)**, Volume 4 Issue 2

Publisher: ACM Press

Full text available:  pdf(324.21 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In the education literature, team-based projects have proven to be an effective pedagogical methodology. We have been using *RoboCup* challenges as the basis for class projects in undergraduate and masters level courses. This article discusses several independent efforts in this direction and presents our work in the development of shared resources and evaluation instruments. We outline three courses and describe related class projects in order to make the context of our investigation clear ...

Keywords: RoboCup, educational robotics

31 Agent Heterogeneity and Coalition Formation: Investigating Market-Based Cooperative Problem Solving 

David Corneforth, Michael Kirley, Terry Bossomaier
July 2004 **Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems - Volume 2 AAMAS '04**

Publisher: IEEE Computer Society

Full text available: [pdf\(180.09 KB\)](#) Additional Information: [full citation](#), [abstract](#), [index terms](#)

One focus of multi-agent systems research is the notion that complex outcomes or behaviours may be arrived at through the interaction of agents. However, it is still an open question as to how agents in a complex system form coalitions or modules, and how these coalitions self-organize into hierarchies. In this paper, we begin to address this question by investigating agent collaboration in the context of a high-level pattern recognition task. We propose a novel market-based communication protoc ...

32 Whistling in the dark: cooperative trail following in uncertain localization space
Richard T. Vaughan, Kasper Støy, Gaurav S. Sukhatme, Maja J. Matarić
June 2000, Proceedings of the fourth international conference on Autonomous agents

AGENTS

Full text available:  [pdf \(222.93 KB\)](#) Additional Information: full citation, references, citations, index terms.

33 A reactive agent-based problem-solving model: Application to localization and tracking

Franck Gechter, Vincent Chevrier, François Charpillet

December 2006 **ACM Transactions on Autonomous and Adaptive Systems (TAAS)**,
Volume 1 Issue 2

Publisher: ACM Press

Full text available: pdf (1.46 MB) Additional Information: full citation, abstract, references, index terms

For two decades, multi-agent systems have been an attractive approach for problem solving and have been applied to a wide range of applications. Despite the lack of generic methodology, the reactive approach is interesting considering the properties it provides. This article presents a problem-solving model based on a swarm approach where agents interact using physics-inspired mechanisms. The initial problem and its constraints are represented through agents' environment, the dynamics of which i ...

Keywords: Reactive multi-agent systems, localization, mobile robots, tracking

34 Arts session 2: interactive spaces and performance: Motion swarms: video interaction for art in complex environments

Quoc Nguyen, Scott Novakowski, Jeffrey E. Boyd, Christian Jacob, Gerald Hushlak
October 2006 **Proceedings of the 14th annual ACM international conference**

Multimedia MULTIMEDIA '06
Publisher: ACM Press

Publisher: ACM Press

Full text available: [PDF \(6.41 MB\)](#) Additional information: [Full citation](#), [Abstract](#), [References](#), [Index terms](#)

We create interactive art that can be enjoyed by groups such as audiences at public events with the intent to encourage communication with those around us as we play with the art. Video systems are an attractive mechanism to provide interaction with artwork. However, public spaces are complex environments for video analysis systems. Interaction becomes even more difficult when the art is viewed by large groups of people. We describe a video system for interaction with art in public spaces and wi ...

Keywords: art installation, audience interaction, interaction through video, motion analysis, motion history image, swarm art

35 Physicomimetics for Mobile Robot Formations

William M. Spears, Rodney Heil, Diana F. Spears, Dimitri Zarzhitsky

July 2004 **Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems - Volume 3 AAMAS '04**

Publisher: IEEE Computer Society

Full text available: [pdf\(123.24 KB\)](#) Additional Information: [full citation](#), [abstract](#), [index terms](#)

In prior work we established how physicomimetics can be used to self-organize hexagonal and square lattice formations of mobile robots. In this paper we extend the framework to moving formations, by providing additional theoretical analysis and showing how this theory facilitates the implementation of seven robots in a hexagonal formation moving towards a goal.

36 Session 11A: coordination and cooperation II: Non-cooperative dynamics of multi-agent teams

Robert L. Axtell

July 2002 **Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 3 AAMAS '02**

Publisher: ACM Press

Full text available:  [pdf\(250.17 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Results on the formation of multi-agent teams are reviewed and extended. Conditions are specified under which it is individually rational for agents to spontaneously form coalitions in order to engage in collective action. In a cooperative setting the formation of such groups is to be expected. Here we show that in non-cooperative environments-presumably a more realistic context for a variety of both human and software agents-self-organized coalitions are capable of extracting welfare improvement ...

Keywords: equal division, increasing returns, multi-agent coalitions, proportional reward, stationary distribution of group sizes, team formation, transient groups, unstable Nash equilibria

37 Papers: cooperation I: Kaa: policy-based explorations of a richer model for adjustable autonomy

Jeffrey M. Bradshaw, Hyuckchul Jung, Shri Kulkarni, Matthew Johnson, Paul Feltovich, James Allen, Larry Bunch, Nathanael Chambers, Lucian Galescu, Renia Jeffers, Niranjan Suri, William Taysom, Andrzej Uszok

July 2005 **Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems AAMAS '05**

Publisher: ACM Press

Full text available:  [pdf\(796.42 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Though adjustable autonomy is hardly a new topic in agent systems, there has been a general lack of consensus on terminology and basic concepts. In this paper, we describe the multi-dimensional nature of adjustable autonomy and give examples of how various dimensions might be adjusted in order to enhance performance of human-agent teams. We then introduce Kaa (KAoS adjustable autonomy), which extends our previous work on KAoS policy and domain services to provide a policy-based capability for ad ...

Keywords: KAoS, OWL, adjustable autonomy, human-agent teamwork, kaa, policy, trust

38 Papers: robotics: Coordinated exploration of unknown labyrinthine environments applied to the pursuit evasion problem

Damien Pellier, Humbert Fiorino

July 2005 **Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems AAMAS '05**

Publisher: ACM Press

Full text available:  [pdf\(495.86 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper introduces a multi-robot cooperation approach to solve the pursuit evasion problem for mobile robots that have omnidirectional vision sensors in unknown environments. The main characteristic of this approach is based on the robots cooperation by sharing knowledge and making them work as a team: a complete algorithm for computing robots motion strategy is presented as well as the deliberation protocol which distributes the exploration task among the team and takes the best possible out ...

Keywords: coordination, distributed robotics, multiagent systems, pursuit-evasion problem

39 Parallel and distributed systems and networking: A particle swarm model for swarm-based networked sensor systems 

B. Anthony Kadrovach, Gary B. Lamont

March 2002 **Proceedings of the 2002 ACM symposium on Applied computing SAC '02**

Publisher: ACM Press

Full text available:  [pdf\(614.37 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Swarm behavior as demonstrated by flocks of birds, schools of fish, and swarms of insects provide a useful method for implementing a distributed network of mobile sensor platforms. Such mobile sensor swarm systems are useful for various search or surveillance activities. Swarm behavior ensures safe separation between swarm members while enforcing a level of cohesion. These two properties, when considered in the context of sensors and wireless communications, provide for low redundancy coverage a ...

Keywords: distributed processing, networking, particle swarms, robotics, wireless

40 Coordination Artifacts: Environment-Based Coordination for Intelligent Agents 

Andrea Omicini, Alessandro Ricci, Mirko Viroli, Cristiano Castelfranchi, Luca Tummolini

July 2004 **Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems - Volume 1 AAMAS '04**

Publisher: IEEE Computer Society

Full text available:  [pdf\(242.37 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Direct interaction and explicit communication are not always the best approaches for achieving coherent systemic behaviour in the context of Multi-Agent Systems (MAS). This is evident when taking into account recent approaches dealing with environment-based coordination such as stigmergy and, more generally, mediated interaction. In this paper we propose a conceptual, formal and engineering framework based on the notion of coordination artifact, which aims at generally systematising implicit com ...

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Terms used: robot OR intelligent agent or autonomous agent and short term memory and cooperative or swarm

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41 [Learning/self-organization/argumentation: Argumentation based decision making for autonomous agents](#)

Antonis Kakas, Pavlos Moraitsis

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available: [pdf\(203.90 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents an argumentation based framework to support the decision making of an agent within a modular architecture for agents. The proposed argumentation framework is dynamic, with arguments and their strength depending on the particular context that the agent finds himself, thus allowing the agent to adapt his decisions in a changing environment. In addition, in order to enable the agent to operate within an open environment where the available information may be incomplete we have i ...

Keywords: agents, argumentation, decision making

42 [Pervasive pheromone-based interaction with RFID tags](#)

Marco Mamei, Franco Zambonelli

June 2007 **ACM Transactions on Autonomous and Adaptive Systems (TAAS)**, Volume 2 Issue 2

Publisher: ACM Press

Full text available: [pdf\(1.72 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Despite the growing interest in pheromone-based interaction to enforce adaptive and context-aware coordination, the number of deployed systems exploiting digital pheromones to coordinate the activities of situated autonomous agents is still very limited. In this article, we present a simple low-cost and general-purpose implementation of a pheromone-based interaction mechanism for pervasive environments. This is realized by making use of RFID tags to store digital pheromones and by having huma ...

Keywords: RFID tags, Stigmergy, pervasive computing

43 [Posters: Spatial dialog for space system autonomy](#)

Scott Green, Scott Richardson, Vadim Slavin, Randy Stiles

March 2007 **Proceeding of the ACM/IEEE international conference on Human-robot interaction HRI '07**

Publisher: ACM Press

Full text available: [pdf\(1.57 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Future space operations will increasingly demand cooperation between humans and autonomous space systems such as robots, observer satellites, and distributed components. Human team members use a combination of gestures, gaze, posture, deictic references and speech to communicate effectively. When a human team collaborates on a given task, they discuss the task, create a plan and then review this plan prior to execution to ensure success. This is exactly the process we envision for effective huma ...

Keywords: adjustable autonomy, augmented reality, collaboration, human-robotic interaction, multi-modal interfaces, spoken dialog system, virtual tele-presence

44 Perception of change for a socially enhanced robot imitator

 Yuval Marom, Gillian Hayes

June 2000 **Proceedings of the fourth international conference on Autonomous agents AGENTS '00**

Publisher: ACM Press

Full text available: [pdf\(857.81 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

45 Agents, interactions, mobility, and systems (AIMS): An agent model for fault-tolerant systems

 Avelino Francisco Zorzo, Felipe Rech Meneguzzi

March 2005 **Proceedings of the 2005 ACM symposium on Applied computing SAC '05**

Publisher: ACM Press

Full text available: [pdf\(382.80 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper describes the use of fault tolerance in a multi-agent system. Such an approach is based on the modeling of autonomous agents with planning capabilities. These capabilities are used by the agent to recover from faults occurring in its surrounding environment, e.g. hardware faults, or in its internal representation thereof, e.g. software faults. The expected fault-tolerant behavior is tested using fault injection either in the system described by the agent or in the environment in which ...

Keywords: BDI model, CA actions, declarative goals, planning

46 Session 6C: mobile embodied agents: Reinforcement learning for landmark-based robot navigation

 Dídac Busquets, Ramon López de Mántaras, Carles Sierra

July 2002 **Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 2 AAMAS '02**

Publisher: ACM Press

Full text available: [pdf\(61.49 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

47 Information retrieval on the web

 Mei Kobayashi, Koichi Takeda

June 2000 **ACM Computing Surveys (CSUR)**, Volume 32 Issue 2

Publisher: ACM Press

Full text available: [pdf\(213.89 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper we review studies of the growth of the Internet and technologies that are useful for information search and retrieval on the Web. We present data on the Internet from several different sources, e.g., current as well as projected number of users, hosts, and Web sites. Although numerical figures vary, overall trends cited by the sources are consistent and point to exponential growth in the past and in the coming decade. Hence it

is not surprising that about 85% of Internet user ...

Keywords: Internet, World Wide Web, clustering, indexing, information retrieval, knowledge management, search engine

48 Book reviews: Review of "A Reader's Guide to Agent Literacy by Marie A.

 **Bienkowski".**

Marie A. Bienkowski

September 1998 **ACM SIGART Bulletin**, Volume 9 Issue 2

Publisher: ACM Press

Full text available:  pdf(1.55 MB) Additional Information: [full citation](#), [abstract](#), [references](#)

Those of us who are newly arrived on the agent scene have a variety of books available with which to increase our agent vocabulary. In this article, I provide a short review of five books related to agent research. I also discuss several overview papers and the recently published proceedings of the 1997 Autonomous Agents conference. Rather than providing an in-depth, critical analysis of these books (most of which are edited collections of papers), I describe their overall approach, attitude, an ...

49 Coordinating autonomous entities with STL

 Oliver Krone, Fabrice Chantemargue, Thierry Dagaeff, Michael Schumacher

September 1998 **ACM SIGAPP Applied Computing Review**, Volume 6 Issue 2

Publisher: ACM Press

Full text available:  pdf(1.67 MB) Additional Information: [full citation](#), [abstract](#), [index terms](#)

This paper describes ECM, a new coordination model and STL its corresponding language. STL's power and expressiveness are shown through a distributed implementation of a generic autonomy-based multi-agent system, which is applied to a collective robotics simulation, thus demonstrating the appropriateness of STL for developing a generic coordination platform for autonomous agents.

Keywords: autonomous agents, collective robotics, coordination, distributed systems

50 Session 2B: multiagent simulation: Variance in converging puck cluster sizes

 A. Zhang, M. Chung, B. Lee, R. Cho, S. Kazadi, R. Vishwanath

July 2002 **Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 1 AAMAS '02**

Publisher: ACM Press

Full text available:  pdf(320.55 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We investigate the design of control algorithms for puck clustering simulations. Of interest is the control of the variance in puck cluster sizes, particularly when multiple clusters are being created. We present a theoretical framework under which behaviors may be designed which serve to control puck cluster sizes.

Keywords: puck clustering, swarm engineering

51 Artificial life, evolutionary robotics, and adaptive behavior: Autonomous navigation

 system applied to collective robotics with ant-inspired communication

Renato Reder Cazangi, Fernando J. Von Zuben, Mauricio F. Figueiredo

June 2005 **Proceedings of the 2005 conference on Genetic and evolutionary computation GECCO '05**

Publisher: ACM Press

Full text available:  pdf(1.07 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Research in collective robotics is motivated mainly by the possibility of achieving an efficient solution to multi-objective navigation tasks when multiple robots are employed,

instead of a single robot. Several approaches have already been tried in multi-robot systems, but the bio-inspired ones are the most frequent. This paper proposes to augment an autonomous navigation system based on learning classifier systems for using in collective robotics, introducing an inter-robot communication mecha ...

Keywords: ant stigmergy, autonomous navigation, collective robotics, learning classifier systems

52 Cooperation and coordination: Artifacts for time-aware agents 

 Cédric Dinont, Philippe Mathieu, Emmanuel Druon, Patrick Taillibert

May 2006 **Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems AAMAS '06**

Publisher: ACM Press

Full text available:  pdf(258.71 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Time-aware agents are agents capable of reasoning about their tasks duration and deadlines, and, more generally, to manage the temporal aspects of the execution of their tasks. We first focus on the case of agents in charge of long duration computations, sustaining that it is not acceptable for an autonomous agent to remain unaware of its environment for too long. We then consider deadline meetings when several time-aware agents share the same CPU. To achieve these goals, we recognize the import ...

Keywords: CPU sharing, artifacts, coordination

53 Book review: The Artificial Life Route to Artificial Intelligence: Building Embodied, 

 Situated Agents edited by Luc Steels (Lawrence Earlbaum, New Jersey)

Stuart Rubin

July 1996 **ACM SIGART Bulletin**, Volume 7 Issue 3

Publisher: ACM Press

Full text available:  pdf(396.36 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

The book, "The Artificial Life Route to Artificial Intelligence," edited by Luc Steels and Rodney Brooks follows from a workshop held in April of 1991 in the old Priory of Corsendonck, north of Brussels. The workshop was organized by Luc Steels and Rodney Brooks and sponsored by NATO and MIT. The participants were Rodney Brooks, William Clancey, John Hallam, Stevan Harnad, Leslie Kaelbling, Chris Langton, Maja Mataric, Rolf Pfeifer, Tim Smithers, Luc Steels, Charles Taylor, Francis Van Aeken, an ...

54 Strategic directions in artificial intelligence 

 Jon Doyle, Thomas Dean

December 1996 **ACM Computing Surveys (CSUR)**, Volume 28 Issue 4

Publisher: ACM Press

Full text available:  pdf(243.02 KB) Additional Information: [full citation](#), [references](#), [index terms](#)

55 A Pheromone-Based Utility Model for Collaborative Foraging 

Liviu Panait, Sean Luke

July 2004 **Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems - Volume 1 AAMAS '04**

Publisher: IEEE Computer Society

Full text available:  pdf(438.14 KB) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Multi-agent research often borrows from biology, where remarkable examples of collective intelligence may be found. One interesting example is ant colonies' use of pheromones as a joint communication mechanism. In this paper we propose two pheromone-based algorithms for artificial agent foraging, trail-creation, and other tasks. Whereas practically all previous work in this area has focused on biologically-plausible but ad-hoc single

pheromone models, we have developed a formalism which uses mul ...

56 Developing a bidding agent for multiple heterogeneous auctions

 Patricia Anthony, Nicholas R. Jennings

August 2003 **ACM Transactions on Internet Technology (TOIT)**, Volume 3 Issue 3

Publisher: ACM Press

Full text available:  pdf(1.15 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Due to the proliferation of online auctions, there is an increasing need to monitor and bid in multiple auctions in order to procure the best deal for the desired good. To this end, this paper reports on the development of a heuristic decision making framework that an autonomous agent can exploit to tackle the problem of bidding across multiple auctions with varying start and end times and with varying protocols (including English, Dutch and Vickrey). The framework is flexible, configurable, and ...

Keywords: bidding strategy, genetic algorithms, multiple auctions

57 The UMASS intelligent home project

 Victor Lesser, Michael Atighetchi, Brett Benyo, Bryan Horling, Anita Raja, Régis Vincent, Thomas Wagner, Ping Xuan, Shelley XQ. Zhang

April 1999 **Proceedings of the third annual conference on Autonomous Agents AGENTS '99**

Publisher: ACM Press

Full text available:  pdf(1.23 MB)

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58 Adaptation/load balancing: Agent memory and adaptation in multi-agent systems

 Kristina Lerman, Aram Galstyan

July 2003 **Proceedings of the second international joint conference on Autonomous agents and multiagent systems AAMAS '03**

Publisher: ACM Press

Full text available:  pdf(277.70 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We describe a general mechanism for adaptation in multi-agent systems in which agents modify their behavior based on their memory of past events. These behavior changes can be elicited by environmental dynamics or arise as response to the actions of other agents. The agents use memory to estimate the global state of the system from individual observations and adjust their actions accordingly. We also present a mathematical model of the dynamics of collective behavior in such systems and apply it ...

Keywords: analysis, coalition formation, multi-agent systems

59 Computational complexity in agent systems: Agent interaction in distributed POMDPs

 and its implications on complexity

Jiaying Shen, Raphen Becker, Victor Lesser

May 2006 **Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems AAMAS '06**

Publisher: ACM Press

Full text available:  pdf(365.80 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The ability to coordinate effectively is critical for agents to accomplish their goals in a multi-agent system. A number of researchers have modeled the coordination problem for multi-agent systems using decision theory. The most general models have proven to be extremely complex to solve optimally (NEXP-complete). Some of the more restricted models have been much more tractable, though still difficult (NP-complete). What is missing is an understanding about why some models are much easier than ...

Keywords: complexity, distributed POMDP, interaction

60 Papers: coordination and planning: An integrated token-based algorithm for scalable coordination 

Yang Xu, Paul Scerri, Bin Yu, Steven Okamoto, Michael Lewis, Katia Sycara

July 2005 **Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems AAMAS '05**

Publisher: ACM Press

Full text available:  [pdf\(589.40 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)

Efficient coordination among large numbers of heterogeneous agents promises to revolutionize the way in which some complex tasks, such as responding to urban disasters can be performed. However, state of the art coordination algorithms are not capable of achieving efficient and effective coordination when a team is very large. Building on recent successful token-based algorithms for task allocation and information sharing, we have developed an integrated and efficient approach to effective coord ...

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